

2008 Title 24

VAV Single Zone Unit Controls



Mark Hydeman, PE

Steve Taylor, PE

Jeff Stein, PE

Anna Zhou

Taylor Engineering

Alameda, CA

<http://www.taylor-engineering.com>

July 2006



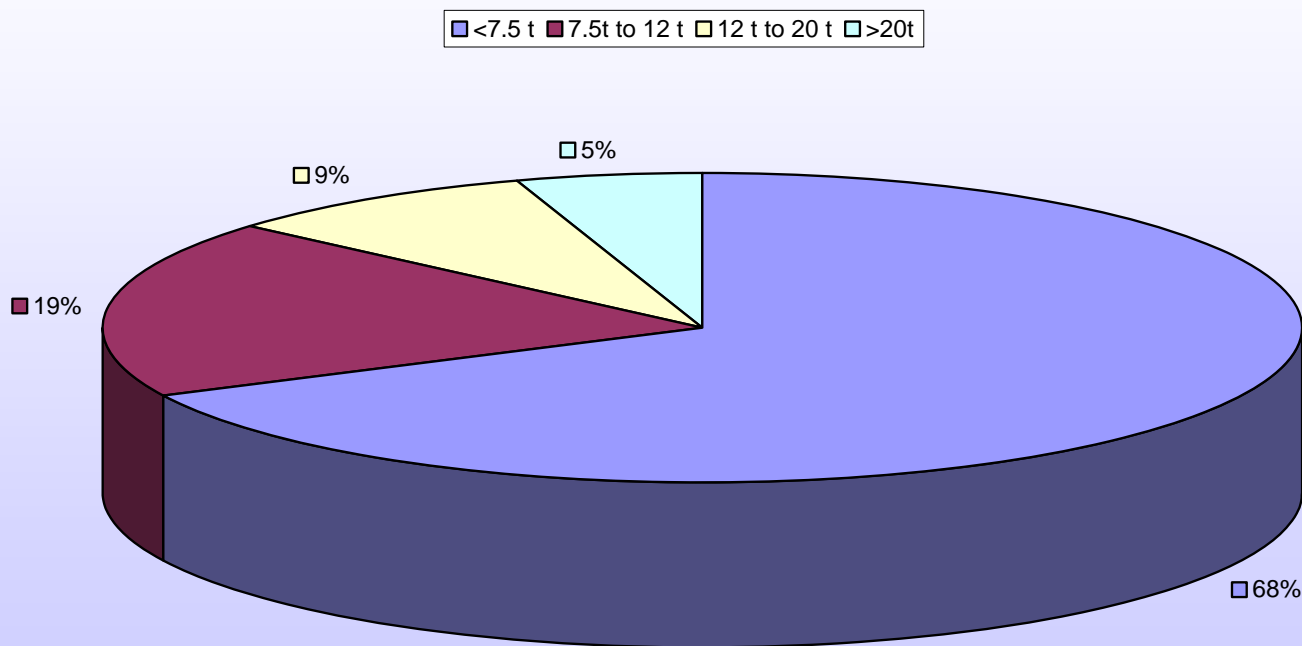
Overview of Proposal

- Create a new prescriptive requirement for VAV single zone systems as follows:
 - Either 2-speed motors or VSDs for units 7-1/2 tons to 12 tons in capacity
 - VSDs or equivalent for units 12 tons and greater in capacity
- Units 7-1/2 tons and above typically have 2 stages of cooling



Background – Unit Sales by Size

AC Unit Distribution by Size
PG&E Commercial End Use Survey Database 1999





Background - Existing Equipment

Table 1 - AC Unit Manufacturers with Existing Unitary VAV DX Equipment

Manufacturer	Minimum VAV Unit Size
Trane	20 ton
McQuay	15 ton
Carrier	20 ton
York	25 ton
Dunham Bush	15 ton
Aaon	2 tons (they have digital scroll compressors)



Analysis

- ❑ Five zone office building run in eQuest on 16 California Climate Zones
- ❑ Units had packaged cooling and furnace heating
- ❑ 2-Speed motors simulated with low speed enabled
 - Whenever the coil load was less than 50% of the design capacity (to simulate two equally sized compressors) and the economizer was at minimum position, and
 - When the economizer could provide 100% of the cooling



Analysis Results

(Summary of 16 Zones)

Table 2 – Simulation Results^[i]

	Savings Per SF of Space		Threshold Cost for 7-1/2ton unit	
Climate Zone	67% Fan	50% Fan	67% Fan	50% Fan
Maximum	\$ 0.76	\$ 0.95	\$ 2,300.00	\$ 2,800.00
Minimum	\$ 0.34	\$ 0.43	\$ 1,000.00	\$ 1,300.00
Average	\$ 0.49	\$ 0.61	\$ 1,468.75	\$ 1,837.50

Table threshold costs are based on 400 ft² per ton. Note that at \$500/ton these threshold costs represent approximately a 50% premium for the unit (base costs are \$3,750 for a 7-1/2 ton unit).



Proposed Requirement

144(x) Variable air volume control for single zone systems. All unitary and air-handling units with cooling serving single zones shall be designed for variable air volume as follows:

1. Units with a cooling capacity greater than or equal to 7.5 tons to less than 12 tons shall have 2-speed motors, variable speed drives or equivalent.
2. Units with a cooling capacity greater than or equal to 12 tons shall have variable speed drives or equivalent.



What is required to meet this proposed requirement?

- ❑ 2-stage thermostat (standard equipment)
- ❑ 2-speed mMotor with 2-speed starter (standard equipment)
- ❑ Several relays (standard equipment)
- ❑ Extra potentiometer for 2 different minimum positions for OSA (standard equipment)



Survey Results

- ❑ Survey sent to product managers in Trane, McQuay, Carrier and York
- ❑ Prior to submission of the proposal three of the four replied. All three supported the proposed requirement to a certain extent
 - One supports the measure as written
 - One supports a VSD measure down to 12 tons that takes effect on 1/1/2009
 - The third supports the proposal down to 15 tons on 1/1/2008 and down to 7-1/2 tons by 1/1/2009



Summary

- ❑ Huge potential energy savings if implemented
- ❑ One custom manufacturer has equipment that would meet this requirement today
- ❑ The 4 major AC unit manufacturers have equipment today that would meet this requirement down to 25 tons today
- ❑ 2 out of the 4 major AC unit manufacturers would support this measure if it were delayed in implementation until 1/1/2009
- ❑ 3 out of 4 major AC unit manufacturers would support this measure if the floor was 12 tons with VSDs



Questions

